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COMMENTS TO H. MOTT'S MEMO (1).(U)
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RFSS

COMMENTS TO H. MOTT'S MEMO

TECH NOTE 105-049

14 SEP 78

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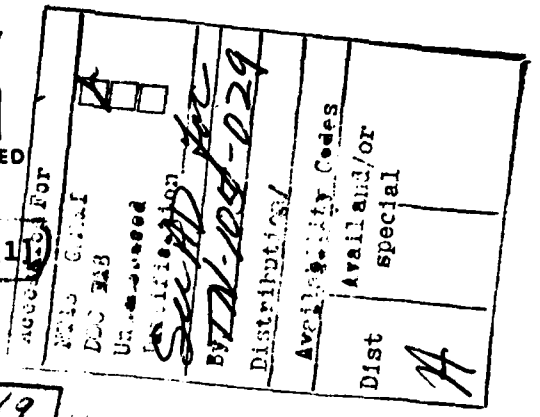

(6) COMMENTS TO H. MOTT'S MEMO [1]

(10) by R. L. Mitchell

(14) MRI-149-32

(14) MRI-TN-145-049

Professor Mott raised certain issues in the referenced memo concerning the Mark Resources' approach to modeling clutter. In this note we respond to his comments, and we outline the basic capability of the computer program.

First of all we point out that there are two fundamental methods of generating clutter signals: (1) the three-parameter model, and (2) the real-time FFT approach. While the first method is computationally very fast, it is severaly limited in its flexibility to approximate the spectral shapes of the three monopulse channels [2]. The FFT approach is an exact one, in that any spectral shape can be accommodated. However, the real-time constraint forces us to use approximations even in this case. But with the program delivered [3] the accuracy is generally within 2 or 3 dB for a wide variety of engagement geometries, compared to a 10 or 15 dB accuracy that would result with the three-parameter model.

It was determined in May 78 that no tapped-delay lines would be available for the tests in the fall 78. Therefore it was recommended ~~by MRI~~ that the more exact approach, namely the one based on the real-time FFT should be implemented for the Tri-Fast tests. Because of the more time-consuming computation, this program can only be used for a single range gate, at least with the present digital computation capability at the RFSS.

Now to the specific issues raised by Professor Mott.

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[1] Mott, H., "MRI Fortran Program for Clutter--Comments," 23 Aug 78.

[2] Mitchell, R. L., and I. P. Bottlik, "Design Requirements for Simulating Realistic RF Environment Signals on the RFSS," MRI Report 132-44, 23 Sept 77.

[3] Mitchell, R. L., "Generating Real-Time Clutter Sequences--Second Fortran Version," MRI Report 149-27, 18 July 78.

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"Real Clutter"

The MRI model is based on a homogeneous earth. Real clutter is nonhomogeneous because of differences in terrain type (foliage or lack thereof, and shadowing). These nonhomogeneities could be included in a computer program of an open-loop simulation by simply describing the nonhomogeneities statistically. Little effort would be involved. However, in a closed-loop simulation one must describe how the non-smooth spectra vary as the receive beam scans across the nonhomogeneous terrain. The task is difficult already without adding another order of complexity. In our opinion little would be gained by adding this type of realism, at least in terms of the resulting miss distance. This conjecture can be verified in an off-line simulation.

Doppler Sidelobes

The objective of MRI was to simulate the clutter spectrum over a 40 dB dynamic range. There are no antenna sidelobes in Tri-Fast higher than -18.5 dB (-37 dB two-way) that would contribute to Doppler sidelobes. It is our intention to treat all sidelobes as being spectrally flat at some level (e.g., -40 dB), so that they can be approximated by thermal noise at that level.

Range Ambiguous Clutter

For Tri-Fast only one range ambiguous interval will be seen by the receiver. The other ambiguities will be out of band.

Same Clutter for all Range Gates

This is a hardware limitation, and the program was designed to provide the most accurate representation of clutter within the computation time constraint.

With the tapped-delay lines and modulators, the three-parameter model will probably have to be implemented. This means another program development effort, but one will have all the tools to compare the various methods of generating clutter.

"Bad" Performance for Dive Angles Greater than 60°

Performance begins to be degraded as the dive angle increases beyond about 45°. It is unfair to use the adjectives good or bad until actual performance results are obtained. We feel that consistent results will be obtained for dive angles up to about 60°. It may work for larger angles, but is this really a case of practical interest?